DOCUMENT RESUME

ED 100 692 88 SE 018 590

TITLE Industrial Arts 9-12, Environmental Education Guide.
INSTITUTION Project I-C-E, Green Bay, Wis.
SPONS AGENCY Bureau of Elementary and Secondary Education (DHEW/OE), Washington, D.C.; Wisconsin State Dept. of Public Instruction, Madison.
PUB DATE [74]
NOTE 86p.

EDRS PRICE MF-$0.75 HC-$4.20 PLUS POSTAGE
DESCRIPTORS *Conservation Education; *Environmental Education; *Industrial Arts; Instructional Materials; Interdisciplinary Approach; Learning Activities; Natural Resources; Outdoor Education; Science Education; *Secondary Education; *Teaching Guides
IDENTIFIERS Elementary Secondary Education Act Title III; ESEA Title III; Instruction Curriculum Environment; *Project I C E

ABSTRACT

This industrial arts guide, for use in grades 9-12, is one of a series of guides, K-12, that were developed by teachers to help introduce environmental education into the total curriculum. The guides are supplementary in design, containing a series of episodes (minilessons) that focus on the economical use of materials and resources and the problems of economic gain versus environmental loss. The episodes are built around 12 major environmental concepts that form a framework for each grade or subject area, as well as for the entire K-12 program. Although the same concepts are used throughout the K-12 program, emphasis is placed on different aspects of each concept at different grade levels or in different subject areas. This guide focuses on aspects such as plastics, power mechanics, and graphic arts. The 12 concepts are covered in one of the episodes contained in the guide. Further, each episode offers subject area integration, subject area activities, interdisciplinary activities, cognitive and affective behavioral objectives, and suggested references and resource materials useful to teachers and students. (Author/TK)

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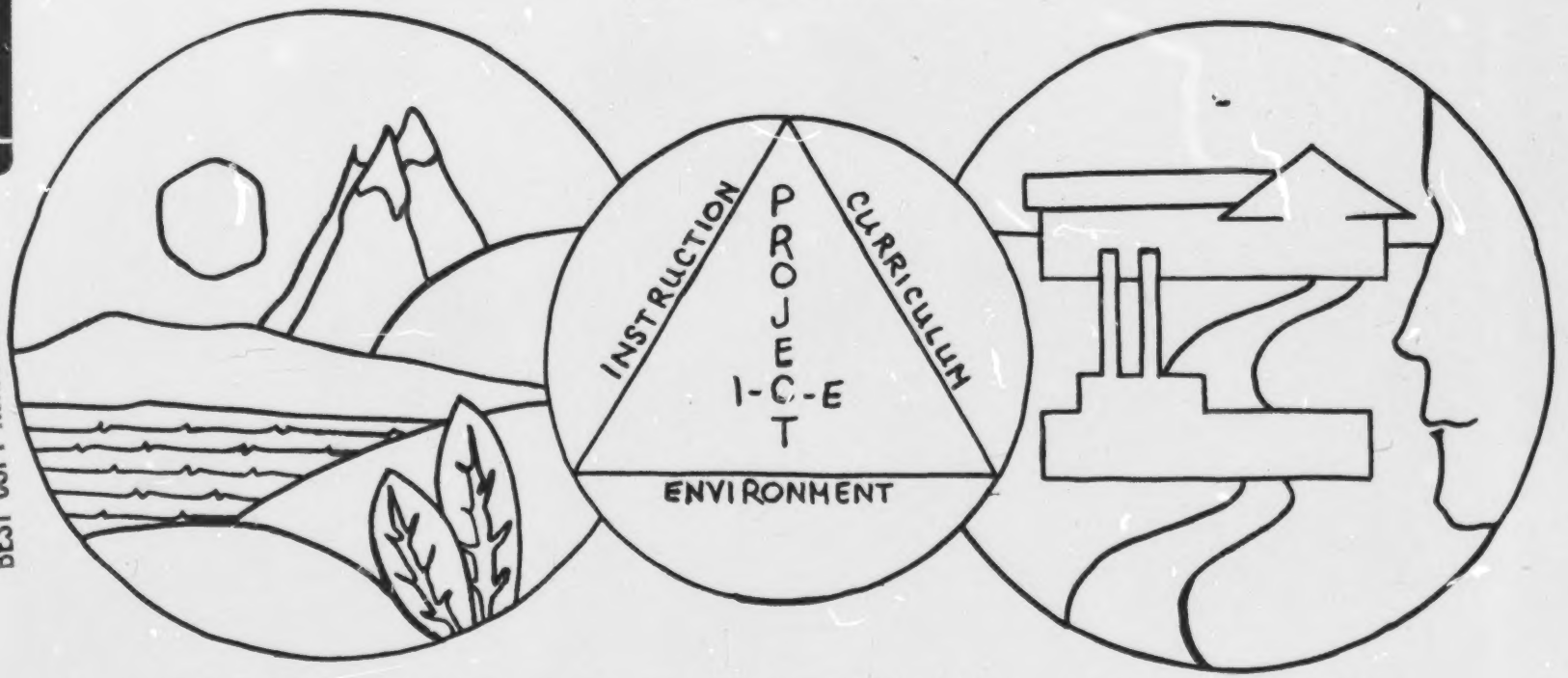
ENVIRONMENTAL EDUCATION GUIDE



INDUSTRIAL ARTS 9-12

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These materials were produced pursuant
to a grant under Title III, E.S.E.A.
The Wisconsin Department of Public Instruction
Project No. 59-70-0135-4

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FORWARD TO PROJECT I-C-E ENVIRONMENTAL EDUCATION GUIDES

In 1969, the First Environmental Quality Education Act was proposed in the United States Congress. At the time of the introduction of that legislation, I stated:

"There is a dire need to improve the understanding by Americans of the ominous deterioration of the Nation's environment and the increasing threat of irreversible ecological catastrophe. We must all become stewards for the preservation of life on our resource-deficient planet."

In the three years since the Environmental Education Act was passed by the Congress, much has happened in the United States to reinforce the great need for effective environmental education for the Nation's young people. The intensive concern over adequate energy resources, the continuing degradation of our air and water, and the discussion over the economic costs of the war against pollution have all brought the question of the environmental quality of this nation to a concern not merely of aesthetics but of the survival of the human race.

The intense interest by the public in the quality of our lives as affected by the environment clearly indicates that we cannot just use incentives and prescriptions to industry and other sources of pollution. That is necessary, but not sufficient." The race between education and catastrophe can be won by education if we marshall our resources in a systematic manner and squarely confront the long-term approach to saving our environment through the process of education.

As the incessant conqueror of nature, we must reexamine our place and role. Our world is no longer an endless frontier. We constantly are feeling the backlash from many of our ill-conceived efforts to achieve progress.

Rachel Carson's theme of "reverence for life" is becoming less mystical and of more substance as our eyes are opened to much of the havoc we have wrought under the guise of progress. A strong commitment to an all-embracing program of environmental education will help us to find that new working definition of progress that is a pre-requisite to the continued presence of life on this planet.

- Senator Gaylord Nelson

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INDUSTRIAL ARTS AND THE ENVIRONMENT

PREFACE

Industrial arts students are users of the resources that are needed by all. Being made aware of this is probably more important today than at anytime in the past. Newspapers, magazines, and other media are constantly reminding us of shortages and the need to conserve.

In industrial arts, many different kinds and types of materials are being used. Teachers have the opportunity and obligation to show and demonstrate economical use of these resources and materials in a very positive way.

It is a known fact industry has been more interested in economic gain than environmental losses. This concept is easily related to any area of industrial arts. An example can be shown in the study of project planning, production of lumber, steel making, exhaust emission, paper making and many others. The teacher may choose the class activity that best fits his subject area. Not all activities must be used. Topics and terms are provided so students may do extra credit work in areas that suit their school or community.

ACKNOWLEDGEMENT

The interest and dedicated effort of the following teachers from Wisconsin Area "B" has led to the development of the Project I-C-E Environmental Education K-12 series:

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PROJECT I-C-E TWELVE MAJOR ENVIRONMENTAL CONCEPTS

1. The sun is the basic source of energy on earth. Transformation of sun energy to other energy forms (often begun by plant photosynthesis) provides food, fuel and power for life systems and machines.

2. All living organisms interact among themselves and their environment, forming an intricate unit called an ecosystem.

3. Environmental factors are limiting on the numbers of organisms living within their influence. Thus, each ecosystem has a carrying capacity.

4. An adequate supply of clean water is essential to life.

5. An adequate supply of clean air is essential for life.

6. The distribution of natural resources and the interaction of physical environmental factors greatly affect the quality of life.

7. Factors such as facilitating transportation, economic conditions, population growth and increased leisure time influence changes in land use and population densities.

8. Cultural, economic, social, and political factors determine man's values and attitudes toward his environment.

9. Man has the ability to manage, manipulate and change his environment.

10. Short-term economic gains may produce long-term environmental losses.

11. Individual acts, duplicated or compounded, produce significant environmental alterations over time.

12. Each person must exercise stewardship of the earth for the benefit of mankind.

A "Concept Rationale" booklet and a slide/tape program "Man Needs His Environment" are available from the I-C-E RMC to more fully explain these concepts.

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DIRECTIONS FOR USING THIS GUIDE

This guide contains a series of episodes (mini-lesson plans), each containing a number of suggested in and out of class learning activities. The episodes are built around 12 major environmental concepts that form a framework for each grade or subject area, as well as for the entire K-12 program. Further, each episode offers subject area integration, multi-disciplinary activities, where applicable, both cognitive and affective behavioral objectives and suggested reference and resource materials useful to the teacher and students.

1. This I-C-E guide is supplementary in design--it is not a complete course of study, nor is its arrangement sequential. You can teach environmentally within the context of your course of study or units by integrating the many ideas and activities suggested.

2. The suggested learning activities are departures from regular text or curriculum programs, while providing for skill development.

3. You decide when any concepts, objectives, activities and resources can conveniently be included in your unit.

4. All episodes can be adapted, modified, or expanded thereby providing great flexibility for any teaching situation.

5. While each grade level or subject area has its own topic or unit emphasis, inter-grade coordination or subject area articulation to avoid duplication and overlap is highly recommended for any school or district seeking effective implementation.

This total K-12 environmental education series is the product of 235 classroom teachers from Northeastern Wisconsin. They created, used, revised and edited these guides over a period of four years. To this first step in the 1,000 mile journey of human survival, we invite you to take the second step--by using this guide and by adding your own inspirations along the way.

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Environmental:

CONCEPT NO. 1 - Energy

ORIENTATION Origin of Plastics

Integrated with:

SUBJECT Industrial Arts (9-12)

TOPIC/UNIT Plastics

BEHAVIORAL OBJECTIVES

Cognitive:

Produce a flow chart of three types of plastics showing sun energy to be the basic source. Analyze the statement, "Plastics have led to a reduction in the use of non-renewable resources."

Affective:

Accept the importance of the sun's energy to the origin of plastics. Choose to design an object to be made from wood or wood products rather than non-wood, plastics if possible.

Skills Used:

1. Types of plastics.
2. Flow charts.
3. Researching.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Have on hand a number of examples of different types of plastics, with type written on.
B. What do these plastics have in common?
C. Divide students into small groups and have them back trace their particular type. (see origin of plastics chart attached.)
D. With class discussion, emphasize importance of "sun energy" as it relates to life processes.
   1. What role does the sun play in the origin of plastics?
   2. Would it be possible to have plastics without the sun? Why?
   3. What affects does the sun have in plastics?

Outside or Community:

A. School chemistry teacher.
B. Representative from the plastics industry to discuss origin of plastic.

SUGGESTED RESOURCES

Publications:

Woodworker Annual, Volume 73, V. J. Taylor, Drake Publishers, 440 Park Avenue, South New York, New York 10016.
Plastics Technology, Robert S. Swanson, McKnight & McKnight, Booomington, Illinois.
General Plastics Proj. & Proc. Raymond Cherry, McKnight & McKnight, Bloomington, Illinois.

Audio–Visual:

#51778, Origin & Synthesis of Plastic Materials, University of Illinois, Champaign, Illinois.

Community:

Chemistry instructor.
Rep. plastic industry.

CONTINUED OR ADDED LEARNING ACTIVITIES

1. Develop method of simple tests composed of burning - smelling - scratching to identify types of plastics.
   Pg. 70, Woodworking Annual, Volume 73.

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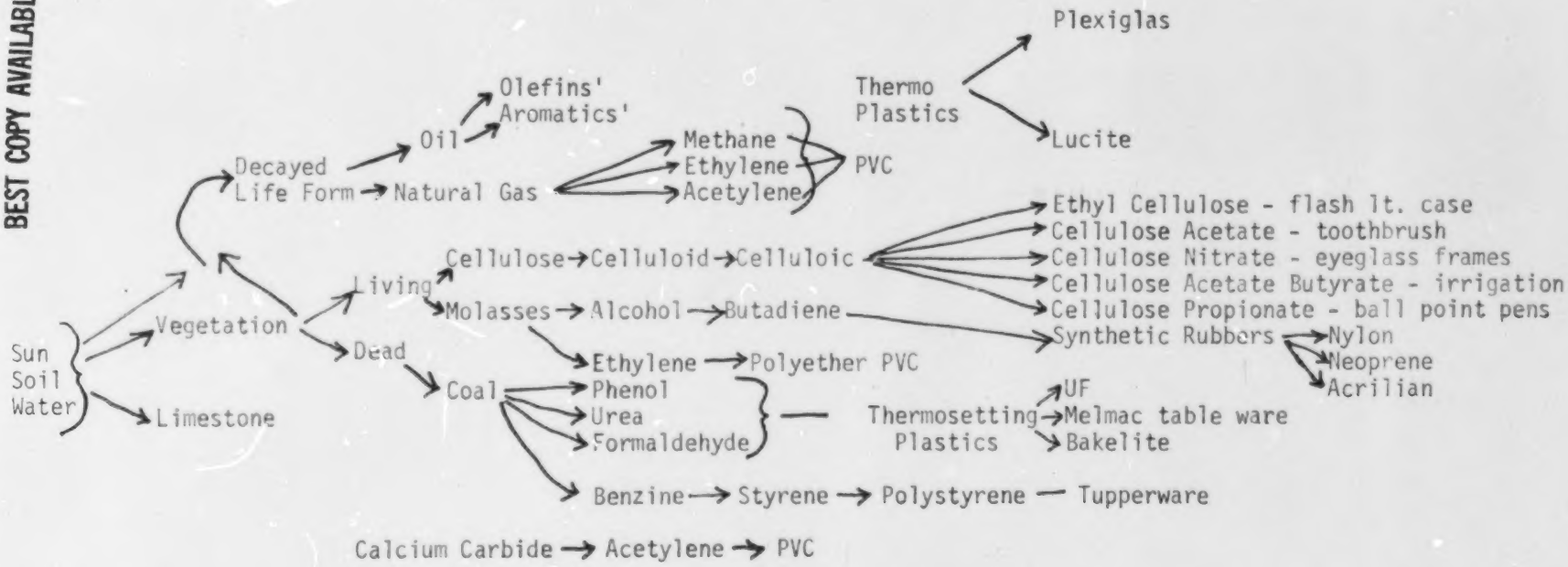
ORIGIN OF PLASTICS



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Environmental:

Integrated with:

CONCEPT NO. 2 - Ecosystem

SUBJECT Industrial Arts (9-12)

ORIENTATION Polymerization

TOPIC/UNIT Plastics

BEHAVIORAL OBJECTIVES

Cognitive:

Define polymerization. Diagram the polymerization process.

Affective:

Willing to visualize how people working together to build a community can be compared to polymerization.

Skills Used:

1. The process of polymerization.
2. The working of an ecosystem.

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Define polymerization -
"Poly" = many
"Meros" = parts
B. Diagram how many parts of monomer link together to form new material.
C. Relate polymerization to an ecosystem.
   1. Compare individual molecules to individual people.
   2. Compare linking of molecules to people working together, in ecosystem, in an economic system.
   3. Compare links to careers which affect other careers or job fields, related industries.

Outside or Community:

A. Chemistry teacher.
B. Counselor-Job opportunities.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Cope's Plastics Book, Dwight Cope Goodheart-Willcox. General Plastics, Raymond Cherry McKnight & McKnight. Job Opportunities Handbook. **Audio–Visual:** Chemistry chart showing polymerization. **Community:** Chemistry teacher.	

E. S. E. A. Title III — PROJECT I-C-E 59-70-0135-4

Environmental:

Integrated with:

CONCEPT NO. 3 - Carrying Capacity

SUBJECT Industrial Arts (10-12)

ORIENTATION Fastening of Plastics

TOPIC/UNIT Plastics

BEHAVIORAL OBJECTIVES

Cognitive:

Develop a chart listing the methods of joining plastics, examples of these methods, and breaking points of the joints. Demonstrate one of the procedures used to test the strength of a plastic. Explain how the breaking point of a plastic is similar; different from that of an environment.

Affective:

Realize that each joining method or system has a definite load limit that must be exceeded before failing.

Skills Used:

1. Types and methods of plastic joinery.
2. Joint testing and evaluation.
3. Chart making.

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Demonstrate methods of joining plastics. (Show, tell and do.)
   1. Cohesion
      a. Solvent cementing
      b. Thermal welding
   2. Adhesion
      a. Adhesive (different from either of materials).
   3. Mechanical linkage
      a. Screws
      b. Rivets
      c. Bolts and nuts
      d. Spring clips

B. Using equipment available, test to determine how much of a load each joint will carry before failing.

C. By brainstorming, relate carrying capacity of joints to carrying capacity of examples in our environment.
   1. Street--can handle only so much before problems occur.
   2. Water main--(same)
   3. Job opportunities--load limit in local community.

Outside or Community:

A. Chemistry teacher.

B. Representative of plastics industry to discuss methods of joining plastics. (i.e. DuPont, etc.)

C. Various local people discussing area job possibilities.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Plastics Technology, Robert S. Swanson McKnight & McKnight. General Plastics, Raymond Cherry McKnight & McKnight. **Audio–Visual:** Actual samples of joints. Transparency series. **Community:** Plastics Industry Rep. (i.e. DuPont) Schwichtenberg-Polyfoam Lester Prarie, Minn.	1. Create larger chart for class room use of a. types of joints b. methods of making them c. breaking points. 2. Have students find samples of different types of joints and use these to supplement chart (#1) to produce multi-media display. 3. Have students perform same type of research with other materials used in industrial arts and present their results. 4. Prepare list of standard fasteners that are used for plastics as well as other materials.

E. S. E. A. Title III – PROJECT I-C-E 59-70-0135-4

Environmental:

Integrated with:

CONCEPT NO. 4 - Water

SUBJECT Industrial Arts (9-12)

ORIENTATION Mold Release

TOPIC/UNIT Plastics

BEHAVIORAL OBJECTIVES

Cognitive:

List and demonstrate the use of various methods of mold release. Compare the three methods in terms of the pollution. Set up criteria to be used for the selection of a mold release method.

Affective:

Select the simplest, yet best method, of mold release for the item he is producing. Suggest ways that can be used to reclaim the water for re-use in the release of the molds.

Skills Used:

1. Methods of mold release.
2. Methods to reclaim water used in the mold release process.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Methods of mold release
   1. Water
   2. Air
   3. Ejection
B. In the study of water mold release, the student will list the pollutants added to water by this process.
   1. Heat
   2. Polyvinyl alcohol
   3. Plastic particles.
C. Students will develop plan to reclaim water used in the mold release process.
   1. Distillation
   2. Secondary treatment
D. Students will present debate or defend "their plan" to the class or teacher.

Outside or Community:

A. Rep. from an area plant that does plastic molding.
B. Engineer from local sewage treatment plant.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Fiber Glass Projects and Procedures, Gerald L. Steele McKnight & McKnight. **Audio–Visual:** Teacher-developed slides. **Community:** Rep. from an area plastic molding plant. Engineer from local sewage treatment plant.	

E. S. E. A. Title III – PROJECT I-C-E 59-70-0135-4

Environmental: **Integrated with:**

CONCEPT NO. 5 - Air **SUBJECT** Industrial Arts (9-12)

ORIENTATION Plastic and Air Treatment **TOPIC/UNIT** Plastics

BEHAVIORAL OBJECTIVES

Cognitive:

Select a "plastic" that best suit a specific air cleaning task, and explain how it will clean the air. Describe properties of a plastic needed to remove particles from impure air.

Affective:

Investigate the qualities a "plastic" must possess to remove particulants from dirty air.

Skills Used:

1. Filtration principles.
2. Uses of plastic products for air filtration.
3. Limitations of plastics and filtration.
4. Research techniques.

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Bean bag discussion: How are plastics used to purify air--give a specific example:
   1. Furnace filters
   2. Vacuum cleaner filter
   3. Cigarette filters
   4. Respirator masks
   5. Air filter on car
   6. Glass PAC mufflers
   7. Exhaust fan hoods

B. Research the above applications and discover what properties must the plastic fibers have?

C. Develop charts using the researched properties. Each group assigned or volunteer to research one type of filter.

D. Given a specific air cleaning task, select from chart or research and select a plastic that would best suit the job.

E. Presentation by "air filtration" expert how plastics can clean the air.

Outside or Community:

A. Selected students will interview local industries to discover what particular filtration (both liquid and air) devices they use, and obtain examples where possible. Sample questions for the interview:
   1. What particular air pollution do you have at this plant?
   2. How are you controlling this problem?
   3. How successful have your efforts been?

B. Air filtration specialist, (heat and vent contractor).

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Literature from various filter manufacturers. **Audio–Visual:** Teacher-developed transparency set. **Community:** Heat and vent contractor.	1. Develop a collection of plastic filtration media. 2. The students will organize a clean-your-furnace-filter drive, to promote better furnace operation. Results: a. Efficiency increased b. Shorter burn time--less air pollution c. Cost reduction in operation 3. Develop test to measure amount or % of particulant removed by various "air filtering devices."

E. S. E. A. Title III - PROJECT I-C-E 59-70-0135-4

Environmental: **Integrated with:**

CONCEPT NO. 6 - Resources **SUBJECT** Industrial Arts (8-12)

ORIENTATION Plastic Products Serving as Conservers of Natural Resources **TOPIC/UNIT** Plastics

BEHAVIORAL OBJECTIVES

Cognitive:

List ten products which are now made of plastic (previously made of another material) and predict four possible reasons why the change was made.

Affective:

Gather information that indicates whether or not changing the material a produce is made of will also change in many instances, the geographic area in which it is produced.

Skills Used:

1. Types and uses of plastic products.
2. Composition of plastics.
3. Geographic locations of natural resources.
4. Geographic locations of raw materials used in the manufacture of plastics.

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Brainstorm list of products now made of plastic, formerly made of other natural resources.
   1. Wood--counter and table tops, paneling, bldg. exteriors.
   2. Metal--desks, auto bodies, engine and auto parts, window wash frames.
   3. Glass-plexiglass, dishes, containers.

B. Develop flow chart, and compare geog. locations of plastic raw products and natural resources.

C. Research plant locations producing various plastic products and map them in contrast to locations of plastic raw materials.

D. Study results of work in portion C.

E. Relate results and conclusions of study (part D) to
   1. Have students find information on a given ghost-town, and try to retrace the steps which led to its becoming a ghost-town.

(Continued)

Outside or Community:

A. Representative of local plastics manufacturing industry to discuss how plastic is replacing wood, metal, etc.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Wisconsin Geography, Dept. of Public Instruction 126 Langlon Street Madison, Wisconsin. **Audio–Visual:** Film: Basic Elements of Production, #60196, Univ. of Illinois Champaign, Illinois. **Community:** Plastics manufacturing personnel (if possible). Chamber of Commerce individual to explain in-coming or out-going industries and their effect on the community and quality of life.	In-Class: (Continued) E. 1. a. Commercial factors b. Accessibility c. Natural resources, etc.

E. S. E. A. Title III – PROJECT I-C-E 59-70-0135-4

Environmental:

Integrated with:

CONCEPT NO. 7 - Land Use

SUBJECT Industrial Arts (9-12)

ORIENTATION How Plastic is Used in Leisure Time Vehicles

TOPIC/UNIT Plastics

BEHAVIORAL OBJECTIVES

Cognitive:

List ten plastic products used in leisure time vehicles. Describe several changes in the environment directly resulting from use of plastics that are:

a. harmful
b. beneficial

Affective:

Investigate the ways that plastic has changed the leisure time vehicle industry. Deliberately examine several types of leisure time vehicles to determine the extent of the reduction in natural resources, for each person of capacity.

Skills Used:

1. Uses of plastic in transportation.
2. How the plastic industry has changed the economy.

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Students will develop a list of plastic products used in leisure time vehicles.
   1. Snowmobile bodies
   2. Boats
   3. ALT vehicles
   4. Dune buggy
B. Students will study those items listed which are produced in their area and how they have changed population and economic conditions.

Outside or Community:

A. Rep. from area plant which produces plastic products used in leisure time vehicles.
B. Students interview local businessmen in companies recently affected.
C. Students contact local and nearby Chambers of Commerce for population and economic changes per products developed.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Fiber Glass Projects and Procedures, Gerald L. Steele McKnight & McKnight. Plastics Technology, Robert S. Swanson McKnight & McKnight. **Audio–Visual:** Plastics and Fiberglass: University of Illinois Champaign, Illinois. **Community:** Rep. from area plastics plant.	

E. S. E. A. Title III — PROJECT I-C-E 59-70-0135-4

Environmental:

Integrated with:

CONCEPT NO. 8 - Values and Attitudes

SUBJECT Industrial Arts (9-12)

ORIENTATION Plastics in Furniture

TOPIC/UNIT Plastics

BEHAVIORAL OBJECTIVES

Cognitive:

Separate the plastic parts from the wood parts, given a sample mixture of furniture parts made of wood and plastic.

Affective:

Accept the use of plastic in the furniture industry and change his attitudes toward their use and accept them.

Skills Used:

1. How to distinguish between furniture parts made of wood and plastic.
2. How plastic is used in furniture.
3. How the use of plastic affects the cost of furniture,

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Students will develop a list of ways plastic is used in furniture.
   1. tops
   2. finish
   3. drawers
   4. doors
   5. legs
   6. applique.

B. From the list developed in A, students will develop a list of reasons for the use of plastic in furniture and individual furniture parts.
   1. cost
   2. durability
   3. appearance.

C. Students will be shown examples of identical furniture parts made of wood or plastic. Students discuss:
   1. How can you recognize plastic parts? (By mold marks, etc.)
   2. How does the use of plastic change our values of furniture?

D. Students will be given several furniture parts and asked to identify the material they are made of.

Outside or Community:

A. Rep. from area plastic moldings plant.

B. Local furniture dealer, to show how plastic is used in furniture.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Advanced Woodworking and Furniture Making, John Feirer & Gilbert Hutc-ings Cha. A. Bennett Company. Fiber Glass Projects and Procedures, Gerald L. Steele McKnight & McKnight. **Audio–Visual:** Plastics: Industrial Processes and Products, #86000 Univ. of Illinois Champaign, Illinois. **Community:** Rep. from area plastic molding plant. Local furniture dealer.	

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental: **Integrated with:**

CONCEPT NO. 9 - Management SUBJECT Industrial Arts (7-12)

ORIENTATION Plastic Identification and Recycling TOPIC/UNIT Plastics

BEHAVIORAL OBJECTIVES

Cognitive:

Test four samples and correctly identify them; recycle the thermoplastics, suggest at least two 2nd lives for the thermosets. Explain recycling of plastics.

Affective:

Propose that the cost of injection and thermoforming projects can be held down by the addition of recycleable plastics. Argue the position that some plastic objects will probably never be recycled because this would be in conflict with the values of our society.

Skills Used:

1. Testing plastics
2. Recycling procedure
3. Letter writing
4. Brainstorming

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Each student will bring a sample of three different disposable plastic containers and if possible, discover who manufactures them.
B. Test the samples in class to determine if the plastic is:
   1. Thermoplastic (Recycleable)
   2. Thermoset (Non-recycleable)
   3. Identify-specific type.
C. Since the thermoplastic is recycleable, it presents no problem. Thermosetting plastic does present a problem.
   1. Why does the manufacturer use this type? Write and ask.
   2. Brainstorm alternative 2nd lives.
      a. birdhouses
      b. art forms
      c. household uses
E. In groups define specific reasons why we should be concerned about the problem presented in D-2. (Results should relate directly to Concept #9.)
F. Recycle thermoplastics in shop procedure.
   Test design--see attached sheet.

Outside or Community:

A. Art teacher to make objects from thermoset items.
B. Representative from plastics industry to discuss their particular recycling efforts.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Woodworkers Annual, Vol. 73, V. J. Taylor, Drake Pub. Ltd. General Plastics, Raymond Cherry, McKnight & McKnight, Bloomington, Illinois. **Audio–Visual:** Teacher/student-developed charts--displays--transparencies. **Community:**	

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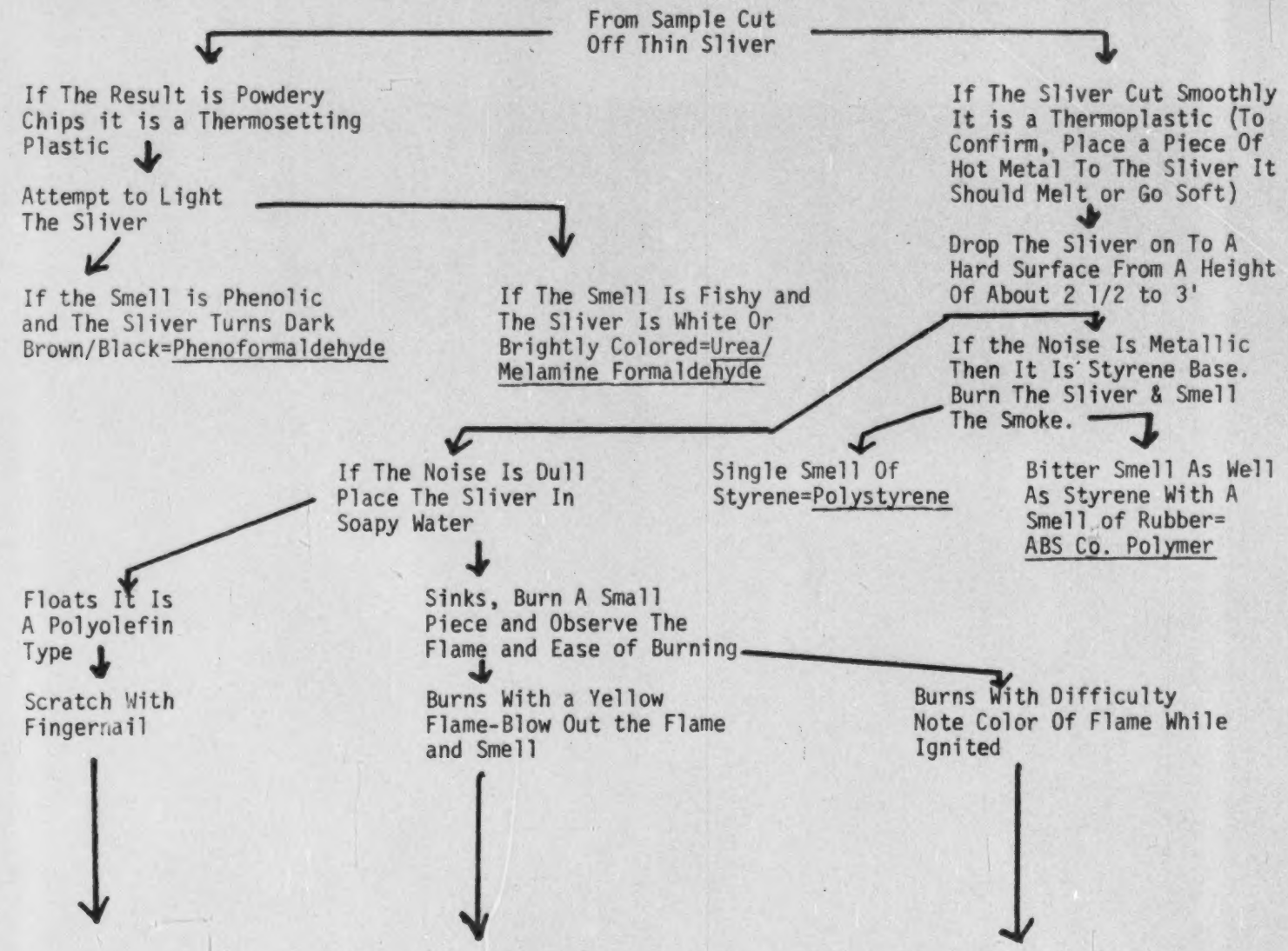
FIELD TESTED TEST DESIGN


From Sample Cut Off Thin Sliver
If The Result is Powdery Chips it is a Thermosetting Plastic
Attempt to Light The Sliver
If the Smell is Phenolic and The Sliver Turns Dark Brown/Black=Phenoformaldehyde
If The Smell Is Fishy and The Sliver Is White Or Brightly Colored=Urea/ Melamine Formaldehyde
If The Sliver Cut Smoothly It is a Thermoplastic (To Confirm, Place a Piece Of Hot Metal To The Sliver It Should Melt or Go Soft)
Drop The Sliver on To A Hard Surface From A Height Of About 2 1/2 to 3'
If the Noise Is Metallic Then It Is Styrene Base. Burn The Sliver & Smell The Smoke.
Single Smell Of Styrene=Polystyrene
Bitter Smell As Well As Styrene With A Smell of Rubber= ABS Co. Polymer
If The Noise Is Dull Place The Sliver In Soapy Water
Floats It Is A Polyolefin Type
Scratch With Fingernail
Sinks, Burn A Small Piece and Observe The Flame and Ease of Burning
Burns With a Yellow Flame-Blow Out the Flame and Smell
Burns With Difficulty Note Color Of Flame While Ignited

Continued:

If It Will Not Scratch=Polypropylene

Scratches A Little= H. D. Polyethylene

Scratches Easily= C. D. Polyethylene

A Smell Like Methylated Spirits=Acrylic

A Smell of Burning Paper= Cellulose Acetate

Acidic Plus A Smell Of Rancid Butter=Cellulose Acetate Butyrate

Greenish Flame

Acrid Smell With Soft Sample=PVC

Acrid Smell With Hard Sample=Rigid PVC or PVC/PVA Co-Polymer

Yellow Flame

Smell Smoke. Smell Of Burning Hair Plus Threads Forming When A Piece Of Cold Metal Is Touched To the Hot Surface & Drawn Away= Nylon

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E. S. E. A. Title III — PROJECT I-C-E 59-70-0135-4

Environmental:

CONCEPT NO. 10 - Economic Planning

ORIENTATION Disposal of Used Plastic Products

Integrated with:

SUBJECT Industrial Arts (9-12)

TOPIC/UNIT Plastics

BEHAVIORAL OBJECTIVES

Cognitive:

List the ways plastic has replaced wood, metal, and glass due to economic factors. Describe several problems of plastic disposal, that had not been problems for wood products. Evaluate the effect of the use of plastic, as a substitute for wood products or glass, on the environment and give your reasons.

Affective:

Choose to buy products made of or contained in recycleable materials rather than thermoplastics. Promote the use of more recycleable and renewable materials instead of plastics derived from fossil fuels.

Skills Used:

1. Methods of disposal of used wood, metal, glass and plastic products.

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Students will develop a list of products once made of metal, wood or glass and now, because of economic factors, made of plastic.
B. Students will study methods of disposing of used products made of w-od, metal, glass and plastic.
   1. metal-recycle
   2. glass-recycle
   3. wood-burn, salvage
   4. plastic
      a. thermoset
      b. thermoplastic-recycle
C. Students will study the problem of disposal of thermosetting plastics.
   1. Study current problems of disposal.
      a. Can not burn in normal fire
      b. Does not decay
      c. Non-recycleable
   2. Develop possible methods of disposal.

Outside or Community.

A. Operator of Recycling Center to discuss recycling of wood, metal, plastic, glass.
B. Visit a hammer mill.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES

Publications:

Plastics Technology,
Robert S. Swanson
McKnight & McKnight.
Industrial Arts Plastics,
Lauton Edwards
Chas. A. Bennett Co., Inc.

Audio–Visual:

Plastics: Industrial Processes and Products, #86000,
Univ. of Illinois
Champaign, Illinois.

Community:

Operator of recycling center.

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental:

Integrated with:

CONCEPT NO. 11 - Individual Acts

SUBJECT Industrial Arts (7-12)

ORIENTATION Recycling Plastics

TOPIC/UNIT Plastics

BEHAVIORAL OBJECTIVES

Cognitive:

List four advantages of recycling thermoplastics and how this action will affect the environment.

a. quality
b. amount of non-renewable resources

Affective:

Attempt to understand the cause-effect relationship utilized in recycling thermoplastics.

Skills Used:

1. Preparing material for recycling.
2. Operation of the granulator.
3. Testing plastics.
4. Record keeping.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

This activity is a continuation of class activity from Concept #10.

A. Students will wash and remove all labels, metal rings, etc. from plastic articles collected from school, home and community periodic collection.
B. Separate according to type of plastic and prepare them for the granulator and granulate.
C. Weigh material and enter weight and date on chart.
D. At the end of the year, add total weight column and compute cost of material recycled. Find per pupil input.
E. Class discussion of Concept #11 as it relates to class recycling effort.
   1. money saved
   2. material saved
   3. land fill effect
   4. conservation of natural resources.

Outside or Community:

A. Sanitary engineer to discuss disposal of plastic material.
B. Chemistry teacher.
C. Rep. from plastic industry to discuss recycling.
D. Set up collection stations for "throw away" plastic articles and maintain same.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Woodworkers Annual, Vol. 73 V. J. Taylor, Drake Pub. Ltd. 440 Park Ave., South, N. Y. 10016. General Plastics, Raymond Cherry McKnight & McKnight Bloomington, Illinois. **Audio–Visual:** Garbage, Project ICE RMC #260. Recycling, Film, ICE RMC #500. **Community:** Sanitary engineer. Chemistry teacher. Rep. from plastics industry.	1. Do long term record keeping over the years so that a greater impact value is developed.

Environmental: **Integrated with:**

CONCEPT NO. 12 - Stewardship **SUBJECT** Industrial Arts (10-12)

ORIENTATION Rights of Others **TOPIC/UNIT** Plastics

BEHAVIORAL OBJECTIVES

Cognitive:

Describe three consequences that might result if the previous "owner" encroached on his rights. List cause and effect of poor prior management of a given resource.

Affective:

Accepts the fact that his actions determine the quality of the project and work of all his classmates involved. Accept the challenge for assisting in the process of bettering the environment, instead of saying "The other generation did it, therefore, I am not responsible."

Skills Used:

1. Proportions.
2. Accuracy in measuring.
3. Set-up times of resins.
4. Responsibility of own actions.

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

Understanding should be realized that when a person is working in an individual effort, the materials, machines, tools, etc. he is using are "his" to use until he is finished. He is also responsible for these materials. Thus, the student is the "owner" of items or materials being used.

A. Demonstration and explanation by teacher on fiberglass resin-mix preparation.
   1. Ingredients (simple)
   2. a. Resin
      b. Hardener

B. Discussion of failures as a result of improper preparation.
   1. If "owner" is not careful and gets resin or hardener into main storage of other the entire mass will be worthless and no other student will be able to use it.
   2. If batch of resin is not thoroughly mixed, the resin and resulting product will be worthless.

(Continued)

Outside or Community:

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Fiber-Glass, Gerald L. Steele McKnight & McKnight **Audio–Visual:** Resin-mixing ingredients in singular form and comparison display in mixed form. **Community:**	In-Class: (Continued) B. 2. (Stress--each person's project or work is dependent upon past performances of other students or "owners." 3. Discover as many areas as possible where neglect by one individual will affect many others.

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Extra Credit Topics and Terms for Students Environmental Study and Exploration.

PLASTICS

Students are to relate information involving these terms to the environment in a written or oral report.

1. Non-degradable Substances
2. Heat in relation to manufacture
3. Use of solvents and acids
4. Air pollution by burning
5. Welding of plastics

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E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental: **Integrated with:**

CONCEPT NO. 1 - Energy **SUBJECT** Industrial Arts (10-12)

ORIENTATION Laser Beam and Type Composition **TOPIC/UNIT** Graphic Arts

BEHAVIORAL OBJECTIVES

Cognitive:

Explain in writing how a laser basically operates and how it is used for the composition of printed matter.

Affective:

Demonstrate an appreciation for the value of the sun's energy for type composition by citing examples of the power of the laser.

Skills Used:

1. Type composition.
2. Physics of light and energy as it is related to the printing industry.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. The student will write a brief paper on the discovery and history of lasers.
B. The student will identify by listing the characteristics of lasers that relate to and from the sun and how it is utilized in the graphic arts industry.
C. Small groups of students will report on:
   1. Industries that use lasers and how they are applied.
   2. Different energy's from the sun that are used for the life process.
   3. Man's future uses of the laser beams.

Outside or Community:

A. Physics teacher to explain lasers and their uses.
B. Physicist or nuclear engineer to explain the history and how lasers are used for the Federal government.
C. Local printer who has knowledge of lasers to discuss the use of them in the printing industry.
D. Visit to a plant that uses lasers for scientific purposes, manufacturing, etc.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Graphic Arts Tech. Found, Inc. 4615 Forbes Avenue Pittsburgh, Pa. 15213 Tech Abstracts **Audio–Visual:** Lasers: An Introduction, #533313, Univ. of Illinois Champaign, Illinois. **Community:** Local printer having knowledge of laser use.	

E. S. E. A. Title III – PROJECT I-C-E 59-70-0135-4

Environmental: **Integrated with:**

CONCEPT NO. 3 - Carrying Capacity **SUBJECT** Industrial Arts (7-12)

ORIENTATION Crowding in the Shop **TOPIC/UNIT** Graphic Arts

BEHAVIORAL OBJECTIVES

Cognitive:

List and explain three physical and three psychological effects of environmental crowding and isolate each of them in specific shop areas. Evaluate crowding in some areas, as a way of freeing land for food production.

Affective:

Willing to accept the fact that crowding results in adverse physical and psychological conditions for all animals including man. Examine the feasibility of several methods used to counteract the effects of crowding in an environment.

Skills Used:

1. Hazards in environmental crowding.

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Conduct experiment around following conditions:
   1. Develop simple task i.e., set business card from Calif. job case.
   2. Provide only one each of tools required.
   3. Limit work area to one job case.
   4. Limit time (slight).
   5. Mass production not allowed.

B. Discuss personal and physical feelings experienced during experiment.
   1. Low production
   2. Confusion
   3. Frustration
   4. Irritability
   5. Waste
   6. Injury

C. Discuss what would result if a town were planned and managed as in the experiment.

D. Relate experiment results to Concept #3.

Outside or Community:

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Graphic Arts, Frederick K. Kagy Goodheart-Willcox. **Audio–Visual:** #53525 Man's Effect on the Environment, Univ. of Illinois. Safety in the Shop, Jam Handy Filmstrip. **Community:** Sociologist. Community planning committee rep. Real estate developer.	

E. S. E. A. Title III – PROJECT I-C-E 59-70-0135-4

Environmental: **Integrated with:**

CONCEPT NO. 4 - Water SUBJECT Industrial Arts (7-12)

ORIENTATION Paper Manufacture Treatment of Waste Water TOPIC/UNIT Graphic Arts

BEHAVIORAL OBJECTIVES

Cognitive:

Name the paper companies having waste water treatment facilities within a 50 mile radius of the school. Explain the process of water treatment, including the types of particles and chemicals removed during the process. Describe the environment in the area if the treatment was not done.

Affective:

Appreciate the clean water for recreation, fishing, etc. Express gratitude for the water treatment process which makes clean water available. Willing to purchase a product from a company having an adequate treatment plant in preference to one not having a treatment plant even though it costs more.

Skills Used:

1. Paper composition.
2. How paper is made.
3. Treatment of water after it is used in a paper mill.
4. Paper selection for specific jobs.

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Lecture and discussion by paper mill rep. "Water treatment facilities in paper companies."
   1. Machines used in treatment.
   2. Chemicals used in treatment.
   3. Results achieved.
   4. Short and long term plans for water treatment facilities.

B. Write a short paper on water treatment on paper mills using lecture notes and related research.

C. Question and answer session with E.P.A. rep. to determine what and who is polluting water and what they are doing.

Outside or Community:

A. Field trip to a paper mill.

B. Public relations department of paper mill to discuss waste water treatment.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Pulp & Paper, 500 Howard Street San Francisco, Calif. 94105. American Paper Industry, 2570 Devon Avenue Des Plaines, Illinois 60018. Chemical Paper Processing, Hale Publishing Company One Bank Street Stanford, Conn. 06901. **Audio–Visual:** Recycling Paper, Riverside Paper Company Appleton, Wisconsin. Great White Trackaway, Hammermill Paper Company Erie, Pa. **Community:** Public relations department - local mill.	1. Develop bulletin board flow chart showing paper making effluent treatment flow chart. 2. Collect water samples from various stages. 3. On a local map, use colored pins to identify paper companies and other industries which use water and return it to the river, lake, etc. (Have the pins denote waste treatment quality.)

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental: **Integrated with:**

CONCEPT NO. 5 - Air **SUBJECT** Industrial Arts (7-12)

ORIENTATION Harmful Vapors **TOPIC/UNIT** Graphic Arts

BEHAVIORAL OBJECTIVES

Cognitive:

List the effects of solvent vapor on the respiratory system.

Affective:

Use safety precautions to prevent the breathing of harmful solvent vapors while in the printing room. Complain if safety precautions were not followed in the printing room and vapors from solvents were not vented properly.

Skills Used:

1. Composition of cleaning solvents.
2. Effects of solvent vapor on the respiratory system.
3. Safe disposal of used solvents.
4. Poster construction.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Student will write a short paper titled: "Is Air Pollution Caused By Cleaning Solvents Used in the Printing Industry?"

B. As a group, the students will develop a plan for effective disposal of used cleaning solvents.

C. Students will construct a safety poster describing the effects of solvents on the respiratory system.

Outside or Community:

A. School chemistry teacher to give demonstration on effects of solvent vapor on materials related to human tissues.

B. Local doctor to discuss effect of solvent vapor on respiratory system.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Graphic Arts, Frederick D. Kagy Goodheart-Willcox. **Audio–Visual:** Ecology and Man Series, McGraw-Hill Filmstrip. **Community:** Local doctor. Chemistry teacher.	

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental: Integrated with:

CONCEPT NO. 6 - Resources SUBJECT Industrial Arts (9-12)

ORIENTATION Water Shortage TOPIC/UNIT Graphic Arts

BEHAVIORAL OBJECTIVES

Cognitive:

Explain the importance of water in the printing process. Predict the effect in the printing industry if water would no longer be available.

Affective:

Given a list of environmental conditions, land, man, employment, recreation that are affected by water shortage, suggest solutions to printing operations that use water and how it can be saved.

Skills Used:

1. Developing film
   a. Inspection
   b. Time and temp.
2. Platemaking with aluminum pre-sensitized plates.
3. Press operations.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Student will write a Philosophical (dream) paper on what might happen to his environment if there was no water.
B. Student will write a letter to the Bureau of the Interior to find out what locales have water shortages and what is being done to correct this i.e., Ventura, Calif.--building reservoirs.
C. Student will make a list of different chemicals that are added to water during printing operations and the amount of difficulty encountered in removing same.

Outside or Community:

A. Biologist with knowledge of water shortage effects on the total environment.
B. Water treatment plant tour.
C. Marine biologist to discuss the effects of chemicals on water and their impact on the ecosystem.
D. Writing assignment could be an interaction between English and graphic arts.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: U. S. Bureau of Interior Water Related Publications Dept. of Natural Resources **Audio–Visual:** #82027, Water-Old Problems, New Approaches, Univ. of Illinois. Ecology and Man Series, McGraw-Hill Filmstrip, Set 3. **Community:** Local marine biologist. Sewage engineer.	1. Have students experiment with ways printing process can eliminate or minimize water use and/or pollution.

E. S. E. A. Title III — PROJECT I-C-E 59-70-0135-4

Environmental:

Integrated with:

CONCEPT NO. 7 - Land Use

SUBJECT Industrial Arts (7-12)

ORIENTATION Packaging for Recycling

TOPIC/UNIT Graphic Arts

BEHAVIORAL OBJECTIVES

Cognitive:

Write an analysis paper on current, local recycling efforts within the community:

a. agencies involved
b. participation of public
c. amount of material.

Compare the reduction in resources when recycling is practiced with when it is not practiced.

Affective:

Save paper and packages for recycling instead of sending them to the dump.

Skills Used:

1. Methods of recycling packages.
2. Methods of designing packages for easier recycling.

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Local official to speak on local recycling efforts.
B. Students will write a brief paper on recycling in your city and make a comparison of these efforts to those of other cities.
C. The student will list the effects of non-recycleable material on land use.

Outside or Community:

A. Designer from packaging company to talk about designing for recycling.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: "Closing the Circle" Keep America Beautiful, Inc. 99 Park Avenue New York, N. Y. 10016. **Audio–Visual:** **Community:** Package designer. Local official.	

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental:

Integrated with:

CONCEPT NO. 8 - Values and Attitudes

SUBJECT Industrial Arts (11-12)

ORIENTATION Plate-making

TOPIC/UNIT Graphic Arts

BEHAVIORAL OBJECTIVES

Cognitive:

List the various metals used in offset printing plates. List the various natural resources used in metal plates and processing materials and their availability. Explain one way that recycling has been practiced in the printing industry for years.

Affective:

Appreciate his socio-economic status as related to natural resources and how some of the resources on his list maintain and improve his standard of living.

Skills Used:

1. Plate make-up.
2. Plate processing.
3. Material derivations-where they come from.
4. Handling of pollutants.
5. Cause-effect thinking.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Lecture--demonstration-discussion on plates and platemaking.
   1. Types of plates
   2. Plate composition
   3. Plate making and processing.
B. Discuss and show (from demonstration) types of pollutants from plates.
   1. Organic oils
   2. Acidic waters
   3. Toxic materials
C. Discuss plate disposal and recycling methods.
D. Relate the flow of events bearing out the fact that resources are needed to promote the flow of communications (via plate produced media) which very directly dictate man's values and attitudes toward his environment.

Outside or Community:

A. Have speaker from local printing firm talk about what they are doing about plate-making wastes, resource control, etc.
B. Have 3-M Corp. Rep. speak on availability of plate-making materials and other related areas.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: U. S. Bureau of Mines Progress Report, Aug. 1970. Photo-Offset Fundamentals, Cogoli, J. E. McKnight & McKnight. **Audio–Visual:** Transparencies on plate-making. **Community:** Local Printing Firm Rep. 3-M Rep.	1. Have students find other examples of progress and resources affecting societys' way of life, and study how resource conservation and waste materials are handled.

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental:

Integrated with:

CONCEPT NO. 9 - Management

SUBJECT Industrial Arts (7-12)

ORIENTATION Noise Pollution

TOPIC/UNIT Graphic Arts

BEHAVIORAL OBJECTIVES

Cognitive:

Identify the machines and/or areas that cause excessive noise and will select appropriate equipment or materials that will reduce the noise level:

a. ear plugs
b. acoustical treatment of area
c. etc.

Affective:

Demonstrate his appreciation of the effect of noise on the physiological system citing examples to illustrate this. Choose the machine with the lowest noise level as being best for the operator.

Skills Used:

1. Offset press operation.
2. Design for noise control.
3. Noise protection.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Lecture-discussion by the teacher or industrial commission rep. on effective noise control and its effect on working conditions. Factors to consider:
   1. Frequency
   2. Overall level
   3. Time distribution of noise exposure
   4. Duration of exposure
   5. Total work life exposure
   6. Susceptibility to noise
   7. Noise classification
      a. auditory
      b. non-auditory

B. Research activity--report on noise provisions of the occupational safety and health act.

C. How are local plants handling noise pollution?

Outside or Community:

A. Rep. from a large printing company who works in the press room to discuss the noise control in his area.

B. Psychiatrist--noise control and its effect on the psychological system.

C. Students volunteer to interview local plant rep. to find and/or taperecord the answers to in-class activity. Students will set up appointments and have questions approved by the teachers before any interview.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Graphic Arts Tech. Found., 4615 Forbes Avenue Pittsburgh, Pa. 14213. Environmental Controls. State: Occupational Safety and Health Act. **Audio–Visual:** #80067, Noise and Health, Univ. of Illinois. #53497, Noise is Pollution, Too, Univ. of Illinois. **Community:** Local safety engineer. Industrial Commission Rep.	1. Have students design and install noise suppression devices on school machines.

E. S. E. A. Title III – PROJECT I-C-E 59-70-0135-4

Environmental: **Integrated with:**

CONCEPT NO. 10 - Economic Planning **SUBJECT** Industrial Arts (7-12)

ORIENTATION Depleting Natural Resources **TOPIC/UNIT** Graphic Arts

BEHAVIORAL OBJECTIVES

Cognitive:

List the natural resources used in paper making. List the ways paper manufacturing is depleting our natural resources. Explain why use of wood or plant fiber type paper is to be preferred over fossil fuel type plastic materials in order to maintain the environment.

Affective:

Appreciate the aesthetic value of natural resources used in paper manufacturing by listing areas in which proper management of paper forestlands have provided an area of beauty.

Skills Used:

1. Paper composition.
2. How to replenish natural resources used in paper manufacturing.

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. View film on papermaking.
B. List paper companies in your area and the natural resources they use.
C. List what each company is doing to replenish the resources they use.

Outside or Community:

A. Visit local papermill.
B. Visit tree farm.
C. Visit papermill waste water treatment plant.
D. Forester from a paper company to discuss reforestation.
E. Public relations dept. of a local papermill.
F. D.N.R. rep. to discuss reforestation.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Printing Views for the Midwest Printer & Lithographer, Feb. 1972. Pulp & Paper 500 Howard St. San Francisco, Calif. 94105. American Paper Industry, 2570 Devon Avenue Des Plaines, Illinois 60018. Ink on Paper, Harper & Row, Arnold, E. C. **Audio–Visual:** Film: Blue Sky Thinking, Hammermill Paper Company Erie, Pa. **Community:** Public relations dept. of a local paper mill. Forester from local paper mill.	

Environmental:

Integrated with:

CONCEPT NO. 11 - Individual Acts

SUBJECT Industrial Arts (10-12)

ORIENTATION Disposal of Rotogravure Plates

TOPIC/UNIT Graphic Arts

BEHAVIORAL OBJECTIVES

Cognitive:

List the ways of cylinder disposal and the effect on his environment. Create new ways of using discarded cylinders in which they would replace other resources, thereby reducing the use of them.

Affective:

Demonstrate awareness of the tremendous use of resources in cyl. products and the eventual disposition of materials and the ultimate results by counting those used in a printshop in a given period of time.

Skills Used:

1. Plastic etchings.
2. Printing from an engraved surface.

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Intaglio printing
   1. Principles of rotogravure printing
      a. Examples of work and plates
      b. Uses for this process
      c. Plastic etchings
         1. Production
         2. Use

B. Have students research the types of metals used in rotogravure cylinder making and the mining impact of their origin. (More cylinders-more impact.)

C. Have students research the disposition of dead cylinders (more cylinders-more waste?).

D. Possible alternatives. (brainstorm) Can they be used for collages, sculptures, abstract design, mobiles, odd furniture, bric-a-brac?

Outside or Community:

A. Tour a local gravure printing plant.

B. Tour an engraving plant.

C. Rotogravure specialist
   1. Metals used
   2. Cylinder usage and disposal.

D. Engraver to discuss types of engraving.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Graphic Arts Monthly.	1. Develop a collection of roto plates and examples. 2. Develop a cost analysis of a roto plate.
Audio–Visual: Teacher-made slide series and/or trans. visualizing intaglio and rotogravure process.	
Community: Local engravure. Local rotogravure specialist.	

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental:

Integrated with:

CONCEPT NO. 12 - Stewardship

SUBJECT Industrial Arts (7-12)

ORIENTATION Ownership of Industry vs. Rights of Ownership

TOPIC/UNIT Graphic Arts

BEHAVIORAL OBJECTIVES

Cognitive:

List ten instances where taking all liberties because a person is an owner of a publication may have negative effects on his environment. Explain why it is sometimes necessary for an industry to be halted in order that the environment be maintained.

Affective:

Defend the statement, "Ownership of a printing establishment does not overule rights and feelings of others." Criticize the idea that an industry has a greater right to a resource than an individual simply because many people's livelihood is derived from it.

Skills Used:

1. Concepts behind "free speech" cliche.
2. "Unwritten" rights of others.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Openly-lead discussion--
   1. Question: What is the difference between reporting and editorializing?
      a. What are the good and bad points of the two types of writing?

B. Relate-through discussion: Just because a person is the owner of a publication, he doesn't have the right to write anything he wishes, just as a person (or persons) doesn't have the right to do anything he wishes with his property, materials, wastes, etc.

C. Role-play situation of editor or publication owner vs., other journalist, community citizen, judge, lawyer.

Outside or Community:

A. Local journalist or English (journalism) teacher to discuss reporting and editorializing.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications:	1. Develop list of all possible areas where "ownerships rights" definitely harm others. 2. Study further into the ways owners are "held in check" from doing what they want in industry.
Audio–Visual: Bill of Rights in Action: Freedom of Speech, #7147, BAVI.	
Community: Local journalist.	

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Extra Credit Topics and Terms for Students Environmental Study and Exploration.

GRAPHIC ARTS

1. Leads
2. Etching
3. Papermaking
4. Screen Printing
5. Press Cleaning
6. Photography

E. S. E. A. Title III – PROJECT I-C-E 59-70-0135-4

Environmental: Integrated with:

CONCEPT NO. 1 - Energy SUBJECT Industrial Arts (9-12)

ORIENTATION Fuel Sources and the Sun TOPIC/UNIT Power Mechanics

BEHAVIORAL OBJECTIVES

Cognitive:

Write a short paragraph briefly explaining the relationship of sun energy to fuel sources.

Affective:

Appreciate the role of sun energy in raw fuel production, by listing examples.

Skills Used:

1. How fuels are formed.
2. How fuels are refined.
3. How fuels are used.
4. How to conserve fuel.

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Thru class discussion, develop a list of combustible fuel sources for use in internal combustion engines.
   1. Oil
      a. gasoline
      b. fuel oil
      c. kerosene
   2. Coal
      a. gas
      b. coke
   3. Natural Gas
      a. propane
   4. Wood
      a. wood alcohol

B. How was/is sun energy responsible for the production of fossil fuels?
   1. Define fossil fuels
   2. List fossil fuel reserves
   3. World supplies.

C. How is sun energy released from fuel?
   1. Burn some fuel oil in a pan to demonstrate release.

D. Films: "Refinery at Work"
   "Story of Gasoline"

Outside or Community:

A. Rep. from petroleum industry to discuss the formation of petroleum.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES

Publications:

Auto Mechanics Fundamentals,
Martin W. Stockel
Goodheart-Willcox.
How To Save Your Car and Gasoline,
Ethyl Car Care Booklet
P. O. Box 55665
Houston, Texas 77055.

Audio–Visual:

Refinery at Work, Shell Film Library.
Story of Gasoline,
U. S. Bureau of Mines.
#52385, Conserving our Natural Resources, Univ. of Illinois.
#00864, Treasures of the Earth,
Univ. of Ill., Champaign, Illinois.
Atomic Power Today-Service With Safety,
ICE RMC, #420.

Community:

1. Rep. from petroleum industry.
2. Fuel oil dealer.
3. Combustion Engineer.

1. Develop collection of "fuels" both raw and refined.
2. Develop bulletin board of fuel cycle (sun-raw-refined).
3. Develop bulletin board of a refinery process.
4. Students with drivers license may conduct field test on cars of various weight to determine m.p.g. (optional).

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental:

Integrated with:

CONCEPT NO. 2 - Ecosystem

SUBJECT Industrial Arts (10-12)

ORIENTATION Internal Combustion vs. External Existence

TOPIC/UNIT Power Mechanics

BEHAVIORAL OBJECTIVES

Cognitive:

Name and compare the four basic systems of an internal combustion engine to the natural systems of existence of an environment in writing.

Affective:

Suggest that the interaction between the four basic systems of an internal combustion engine and the effects produced if one or more systems fail to function properly are similar to that of the parts of the environment and its continued existence.

Skills Used:

1. Principles of internal combustion.
2. Systems analysis.
3. Basic systems of internal combustion
   a. fuel
   b. electrical
   c. cooling
   d. exhaust

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Film on internal combustion.
B. Transparency series and discussion of basic internal combustion systems.
   1. fuel
   2. electrical
   3. cooling
   4. exhaust
C. Discuss function and importance of gauges or performance indicators.
D. Develop flow chart on what results if one of these systems or gauges fails to function properly.
E. Compare basic systems and their functions to people living in today's world. (Compared to) e.g.
   1. Engine--living in general
   2. Fuel--gas, oil, food, electricity
   3. Cooling--air, water.
   4. Exhaust--waste disposal
   5. Gauges--communications.

Outside or Community:

A. Sociologist to discuss interaction.
B. Have students find examples in community and determine basic integral systems and their functions.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Power: Mechanics of Energy Control, Bohn-MacDonald McKnight & McKnight. Power-Prime Mover of Technology, Duffy, McKnight & McKnight. **Audio–Visual:** Film: ABC's of Internal Combustion, General Motors. **Community:** Sociologist.	

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental:

Integrated with:

CONCEPT NO. 3 - Carrying Capacity

SUBJECT Industrial Arts (9-12)

ORIENTATION Crowding in the shop.

TOPIC/UNIT Power Mechanics

BEHAVIORAL OBJECTIVES

Cognitive:

List and illustrate at least three physical and three psychological effects of crowding, orally or in writing.

Affective:

Conclude that crowding results in adverse physical and psychological effects from readings and discussions.

Skills Used:

1. Hazards in environmental crowding.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Conduct experiment around the following conditions:
   1. Develop simple task i.e., students, in pairs, will disassemble a single cylinder engine.
   2. Provide only one each of tools required.
   3. Limit work area to one table.
   4. Limit time.

B. Discuss personal and physical feelings experienced during experiment.
   1. Low production
   2. Confusion
   3. Frustration
   4. Irritability
   5. Waste
   6. Injury

C. What is the result if this happened in town.

D. Relate experienced results to Concept #3.

Outside or Community:

A. Psychologist to discuss mental effects of crowding.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications:	
Audio–Visual: #53525, Man's Effect on the Environment, University of Illinois, Champaign, Illinois. Kt 14 - The Ecological Cycle, ICE.	
Community: Psychologist or sociologist. Community Planning Committee. Real Estate Developer.	

E. S. E. A. Title III – PROJECT I-C-E 59-70-0135-4

Environmental:

Integrated with:

CONCEPT NO. 4 - Water

SUBJECT Industrial Arts (9-12)

ORIENTATION Water Use and Atomic Energy

TOPIC/UNIT Power Mechanics

BEHAVIORAL OBJECTIVES

Cognitive:

List four advantages and two disadvantages of atomic energy as a means of producing electricity.

Affective:

Deduce from readings and discussion, that there are possible detrimental effects of producing electricity by atomic means, as well as advantages. Delay response to a suggestion that it would be best to generate all power using atomic fuel until he obtains more information.

Skills Used:

1. Generation of atomic power.

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Show films Atomic Power Production, How a Boiling Water Reactor Operates.
B. Field trip to a nuclear power plant.
C. Presentation by rep. from local power company.
D. Read text units on Atomic Power Production.
E. Debate in class the advantages and disadvantages of Atomic Power Production.
F. The students will write a report on the effects on water used in the production of atomic power.

Outside or Community:

A. Field trip to a nuclear power plant.
B. Local power company rep.
C. D.N.R. rep. to discuss thermal pollution.
D. A.E.C. rep. to discuss thermal pollution.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Power Technology, Geo. Stephenson, Delmar Publishing. Power, Prime Mover of Technology, Jos. Duffy - McKnight & McKnight. **Audio-Visual:** #6373, Atomic Power Production, BAVI. #1706, How a Boiling Water Reactor Operates, BAVI. Atomic Power Today-Service With Safety, ICE RMC #420. **Community:** Local power company rep. D.N.R. rep. A.E.C. rep.	1. Develop bulletin board on atomic energy production. 2. Develop a newspaper clipping file related to atomic energy production (community involvement). 3. Have students measure and chart water temperature at various distances from an atomic power plant to determine possible thermal pollution of the water.

E. S. E. A. Title III – PROJECT I-C-E 59-70-0135-4

Environmental:

Integrated with:

CONCEPT NO. 5 - Air

SUBJECT Industrial Arts (9-12)

ORIENTATION Air Pollution

TOPIC/UNIT Power Mechanics

BEHAVIORAL OBJECTIVES

Cognitive:

List and describe three emission control devices. Describe four advantages and disadvantages of low/no lead gas. List the procedure for engine tune-up.

Affective:

Demonstrate an appreciation for proper engine tune-ups as a way of reducing pollution of the environment by having his auto or suggesting that his parents have their auto tuned at recommended intervals of time.

Skills Used:

1. Engine tune-up procedures.
2. Use of test equipment.
3. How emission control devices affect the air quality.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Visit car dealership service department. Talk on emission control devices and their maintenance.
B. Round table discussion, "Why do we need emission control devices?" (In summation relate discussion to Concept #5.)
C. Develop a display of emission control devices.
D. Develop a service chart for EC devices.
E. Debate the pros/cons of using low/no lead gasoline.
F. Movies for wrap-up:
   1. Air Pollution and Cars
   2. The Answer is Clear.

Outside or Community:

A. Service Department local dealership.
B. Oil Co. Distributor.
C. D.N.R. rep. to discuss air pollution from cars.
D. GM - Ford - Am. - Cry. rep. to discuss emission control devices.

SUGGESTED RESOURCES

Publications:

Automotive Emission Control,
Wm. H. Crouse, Gregg/McGraw-Hill.
The Quest for Cleaner Air,
Motor Service, Aug. '71.
Principles and Promises of the Wankel,
Road & Track, Feb. '71
Those New Gasolines, Popular Mechanics,
Feb. '71.

Audio–Visual:

To Clean the Air, United World Free
Film Service, 221 Park Ave, N.Y. 10003.
Toward Cleaner Air, Assoc. Sterling
Film, 866 Third Avenue, N.Y. 10022.
Air Pollution and Cars
The Answer is Clear
GM Corp. Public Relations Staff
Film Library GM Bldg., Detroit 48202.
No Time To Waste, Modern Talking
Picture Service, 2523 New Hyde Park Rd.
Long Island, New York 11040.
The 2nd Pollution, ICE RMC #460.
Atomic Power Today-Service With Safety,
ICE.

Community:

Local Service Dept.
Oil Company Dist.
D.N.R. Rep.
Big 3 Rep.

CONTINUED OR ADDED LEARNING ACTIVITIES

1. Write a paper on the development of emission control devices.
2. Develop a graph showing % of air pollution by cars.
3. Develop a graph of various types of engines comparing (1) efficiency (2) % pollution (3) economy.

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental:

Integrated with:

CONCEPT NO. 6 - Resources

SUBJECT Industrial Arts (9-12)

ORIENTATION Transportation of Crude Oil

TOPIC/UNIT Power Mechanics

BEHAVIORAL OBJECTIVES

Cognitive:

Write a research paper on oil pipe lines and their impact on the environment.

Affective:

Investigate articles in resource materials to better understand problems involved in transporting crude oil.

Skills Used:

1. How crude oil is located.
2. Problems involved in transporting crude oil to refinery.
3. Community involvement.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Film: "Prospecting for Petroleum" or similar film.

B. Round table discussion: Now that the oil is discovered and the well brought in, how do you get it to the refinery?
   1. Truck
   2. Boat
   3. Pipe line
   4. Railroad
   5. Combination

C. What factors are considered in selecting a transportation system?
   1. Cost
   2. Environmental impact
   3. Natural terrain
   4. Distance
   5. Profit margin

D. How do the above considerations affect the quality of life at:
   1. Well site
   2. Transportation route
   3. Refinery site?

E. Debate pros and cons of the Trans-Alaska Pipe Line using facts discovered by individual research. (Have one group research pros, other group cons.)

Outside or Community:

A. Oil Co. Rep. to discuss transport systems.

B. D.N.R. to discuss pipe line effects.

C. Dept. of Interior to discuss transport systems.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Free literature from oil companies. **Audio–Visual:** #52385, Conserving Our Natural Resources, University of Illinois. It Might Have Happened, 4195, Modern Talking Picture Service, Milwaukee, 1696 N. Astor. Prospecting for Petroleum, Shell Oil Company 450 N. Meridian St. Indianapolis, Indiana 46204. **Community:** Oil Company Rep. D.N.R. Dept. of Interior	1. Develop map showing the following: a. Well locations 2. Refinery locations 3. Well to refinery routes (color code for mode of transportation). 4. Severe environment impairment sites and description of cause of impairment.

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental: Integrated with:

CONCEPT NO. 7 - Land Use SUBJECT Industrial Arts (9-12)

ORIENTATION Effects of Recreational Vehicles TOPIC/UNIT Power Mechanics

BEHAVIORAL OBJECTIVES

Cognitive:

List five ways in which leisure vehicles, while contributing to our economy, are changing or damaging the environment, and changing our way of life.

Affective:

Investigate the effects recreational vehicles are having on his surroundings and the long-term effects of this change. Argue the point that while contributing to our economy, the recreation vehicle is changing and damaging the environment beyond its benefits.

Skills Used:

1. Research.
2. Harmful results of leisure vehicle operation.
3. Statistic usage.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Develop (through discussion) a list of factors which have contributed to the development and popularity of recreational vehicles.
   1. Snowmobiles
   2. Boats
   3. All terrain vehicles
B. Brainstorm list of detrimental effects to water, land, and air quality as a result of these vehicles.
   1. Pollution of water
   2. Pollution of air
   3. Compacting of land.
C. Have students project (via small group conference and discussion) long-range effects of use of recreational vehicles.
D. Discuss movement of people to "recreational areas" for usage of leisure time.

Outside or Community:

A. Conduct traffic surveys during different times of the year, counting number of vehicles towing recreational vehicles, and comparing to total number of vehicles.
B. Observe areas receiving heavy snowmobile traffic before and after the snowmobiling season. Compare growth of grass on trail and adjacent to it.
C. Chamber of Commerce Rep. to point out major geographic recreation areas.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications:	1. Create map showing geographical locations of major recreational areas and their main type of recreational activity. 2. Draw charts or graphs to illustrate results of traffic survey (Community Activity A). 3. Keep perpetual survey of geographic recreational area use of students in class. This will not only be of benefit in meeting objectives, but can also be used as a local recreational guide.
Audio–Visual: Maps, charts, or graphs developed by students from traffic survey. Time to Begin, Film, D.N.R.	
Community: Chamber of Commerce Rep.	

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental:

Integrated with:

CONCEPT NO. 8 - Values and Attitudes

SUBJECT Industrial Arts (9-12)

ORIENTATION Pollution Control Devices

TOPIC/UNIT Power Mechanics

BEHAVIORAL OBJECTIVES

Cognitive:

List anti-pollution devices required on internal combustion engines. List the cultural, social, political, and economic factors which these devices have caused. Evaluate the effectiveness of the anti-pollution devices in automobiles in comparison to the additional gasoline required per mile of travel.

Affective:

Investigate the factors which lead to the requirement of anti-pollution devices and the effectiveness of their use in newer model automobiles. Spend money to replace non-functioning anti-pollution devices.

Skills Used:

1. The operation of anti-pollution devices on internal combustion engines.
2. Cost analysis.
3. Data gathering.
4. Data analysis.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Students will study anti-pollution devices for internal combustion engines.
B. Students will develop a list of social and political factors which lead to the required use of these devices.
C. Students will figure economic factors which have resulted from the required use of these devices.
D. Student will list cultural factors produced by the required use of these devices.

Outside or Community:

A. Rep. from auto manufacturer to discuss anti-pollution devices.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: National newspapers. Auto Mechanics Fundamentals, Martin W. Stockel Goodheart-Willcox. Power Technology, George E. Stephenson Delmar Publishing. **Audio–Visual:** Charts from auto manufacturers. No Time to Write, Modern Talking Picture Service 1696 N. Astor Milwaukee, Wis. 53202. Atomic Power Today - Service With Safety, ICE RMC #420. **Community:** Rep. from Auto Manufacturer.	

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental:

Integrated with:

CONCEPT NO. 9 - Management

SUBJECT Industrial Arts (9-12)

ORIENTATION Engine Tune-up

TOPIC/UNIT Power Mechanics

BEHAVIORAL OBJECTIVES

Cognitive:

Demonstrate how to properly tune up an engine to reduce exhaust emission and increase engine efficiency. Explain how the increased use of small engines in his area is causing a change in the quality of his environment.

Affective:

Recommend a tune-up because of the difference proper adjustment makes in exhaust emission, both from a pollution and an economic standpoint. Will not disconnect anti-pollution devices on the automobile even when someone asks him to with the reason of increased gas mileage. Support the mechanics certification program as a means of having better mechanics, thereby reducing air pollution.

Skills Used:

1. Carburetor adjustment.
2. Checking and adjusting ignition system.
   1. Plugs
   2. Points

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Discuss increased uses of small engines in recent years.
   1. Develop a list of ways in which small engines are changing our environment.
   2. Using an exhaust analyzer, test emission from a badly tuned engine.
   3. Tune up same engine and retest for exhaust emission.

Outside or Community:

A. Rep. from a small engine repair shop to discuss the importance of engine tune-up.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Power Technology, George E. Stephenson Delmar Publishers. Small Gas Engines, Purvis, Goodheart-Willcox. Auto Mechanics Fundamentals, Martin W. Stockel Goodheart-Willcox. **Audio–Visual:** #51011, Spark In Time On The Firing Line, University of Illinois Champaign, Illinois. **Community:** Rep. from small engine manufacturing firm. Mechanic from local garage or service station.	

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental: **Integrated with:**

CONCEPT NO. 10 - Economic Planning SUBJECT Industrial Arts (9-12)

ORIENTATION Disposal of Waste Oil TOPIC/UNIT Power Mechanics

BEHAVIORAL OBJECTIVES

Cognitive:

List three improper oil disposal methods and write a brief description of possible long-term environmental losses related to disposal. Construct a plan for properly disposing of used oil that could be feasible for the individual who changes his own oil.

Affective:

Infer, from observations and readings that improper disposal of waste oil may cause long-term environmental losses. Choose to dispose of used oil properly to prevent it from interacting with the environment in a negative manner. Attack the sale of oil to individuals on the basis that they do not dispose of used oil properly and therefore cause undue pollution.

Skills Used:

1. Environmental losses as it relates to waste oil disposal.
2. The proper handling of waste oil.
3. Oil changing procedure.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Students will survey local garages to find out how they dispose of waste oil and why they use the method they do. Assign garages so owners are not assaulted by the whole class.
B. Individually report on disposal method discovered.
   1. Dump in sewer
      a. storm
      b. sanitary
   2. Burn
   3. Dump on land
      a. at garage pit
      b. local dump.
   4. Store for reclaim.
   5. Personal reuse.
C. Round table discussion "How Do These Disposal Methods Produce Long-Term Environmental Uses?"

Outside or Community:

A. Local garages.
B. Local oil company.
C. See "I. A."

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Oil Company literature. **Audio–Visual:** Teacher/student-developed slide series. **Community:** Local garages. Oil Company rep.	1. Have students develop alternative waste oil disposal methods that will not have environmental detriments and/or uses for waste oil. 2. Develop slide series on waste oil disposal methods.

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental:

Integrated with:

CONCEPT NO. 11 - Individual Acts

SUBJECT Industrial Arts (9-12)

ORIENTATION Tire Selection

TOPIC/UNIT Power Mechanics

BEHAVIORAL OBJECTIVES

Cognitive:

List three good and three harmful effects of studded tires. Compare the use of studded and snow tires in:

a. original cost
b. lives saved over conventional tire use
c. harm to environment.

Affective:

Remove studded tires from his car whenever their use is not vital. Defend the laws restricting or eliminating the use of studded tires on the basis of loss of resources as a result of studded tires.

Skills Used:

1. The wearing effect studded tires have on highway surfaces.
2. The environmental problems and economic loss involved in highway resurfacing.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Study wheels, hubs, tires
   1. Wheel parts
   2. Hub lubrication
   3. Tire plys
   4. Tire size
   5. Tire balance
   6. Tire inflation
   7. Tire composition
B. Slide presentation on studded tires.
   1. How made
   2. Uses
   3. Effects on road surface
   4. Regulations on use
   5. Comparison to snow tires.
C. Highway engineer to make presentation on highway resurfacing due to studded tires.

Outside or Community:

A. Highway engineer.
B. Tire dealer to discuss studded tires.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Auto Mechanics Fundamentals, Martin W. Stockel Goodheart-Willcox. **Audio–Visual:** Auto Mechanics: Wheels and Tires, #53620. University of Illinois Champaign, Illinois. **Community:** Local tire dealer. State highway engineer.	

E. S. E. A. Title III – PROJECT I-C-E 59-70-0135-4

Environmental:

Integrated with:

CONCEPT NO. 12 - Stewardship

SUBJECT Industrial Arts (9-12)

ORIENTATION Waste of Power Supplies

TOPIC/UNIT Power Mechanics

BEHAVIORAL OBJECTIVES

Cognitive:

List the ways man has wasted power supplies in the areas of wood, coal, oil and gas. Analyze a given commercially available "gadget" advertised as saving a specified fraction of the gasoline presently used per mile of travel.

Affective:

Assist through work with community action groups to reclaim wasted power supplies and conserve the remaining supplies. Choose to walk to a given point rather than take his automobile in an effort to save gasoline. Consolidate his errands to use the least amount of gasoline while doing the errands.

Skills Used:

1. Conservation and reclamation of power supplies.
2. Cooperation.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. The students will study, Man's Struggle to Harness Energy.
   1. Early attempts to control.
   2. Current power developments.
B. The students will develop a list of ways men can reclaim some of the wasted power supplies, and a list of ways man must conserve his remaining power supplies.

Outside or Community:

A. D.N.R. to discuss wasted power supplies.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Power Technology, George E. Stephenson Delmar Publishers, Inc. Encyclopedias. History Books. Power-Prime Mover of Technology, Joseph W. Duffy McKnight & McKnight. **Audio–Visual:** Fuels: Their Nature and Use, University of Illinois Champaign, Illinois. **Community:** D.N.R.	

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POWER MECHANICS

Students are to relate information involving these terms to the environment in a written or oral report.

1. Exhaust control
2. Oil disposal
3. Anti-pollution devices
4. Solar energy
5. Production of electricity
6. Heat from nuclear energy
7. Fossil fuels
8. Noise pollution
9. Water power
10. Wind for energy
11. Wood for fuel